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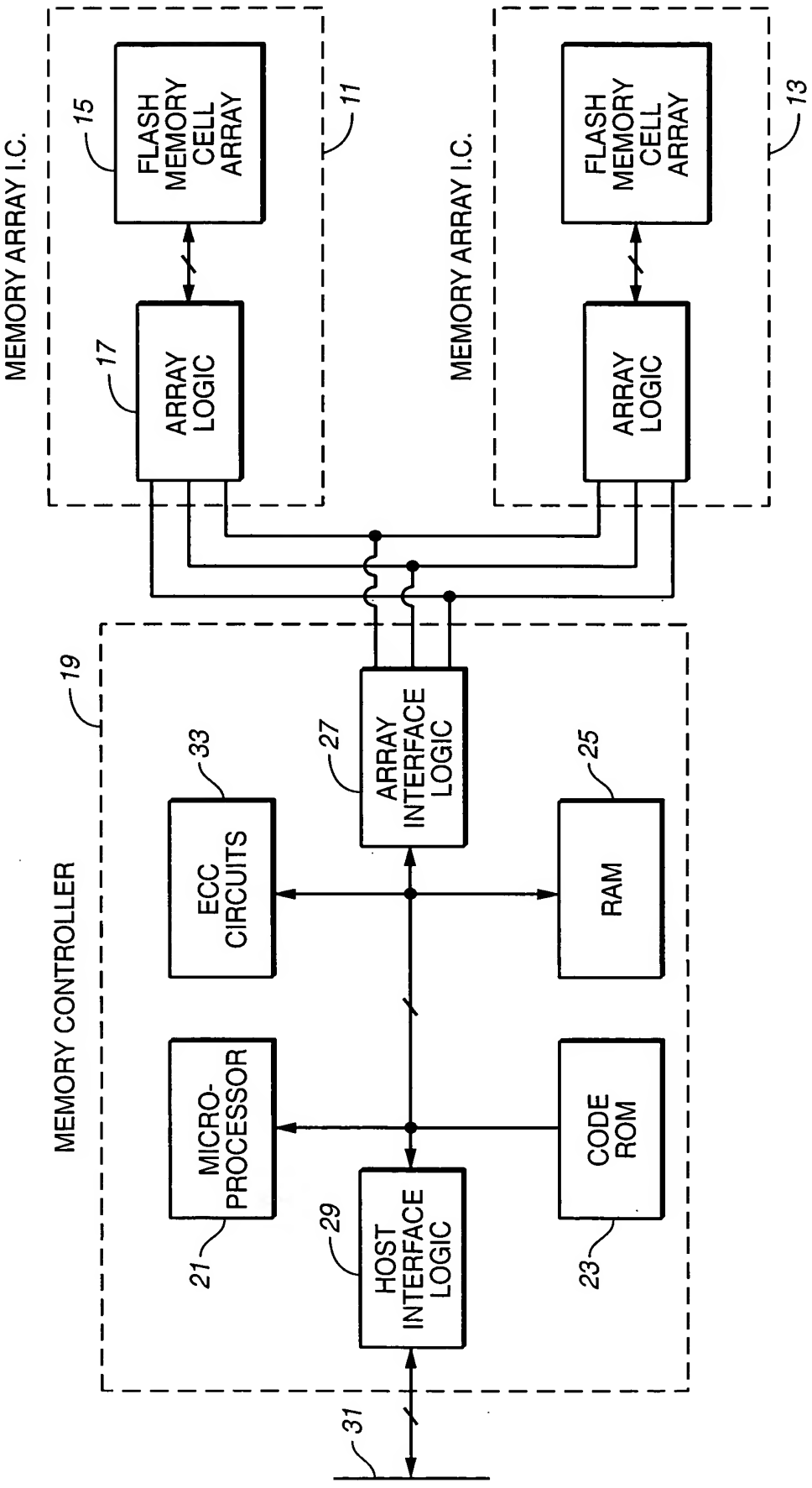


FIG._1A

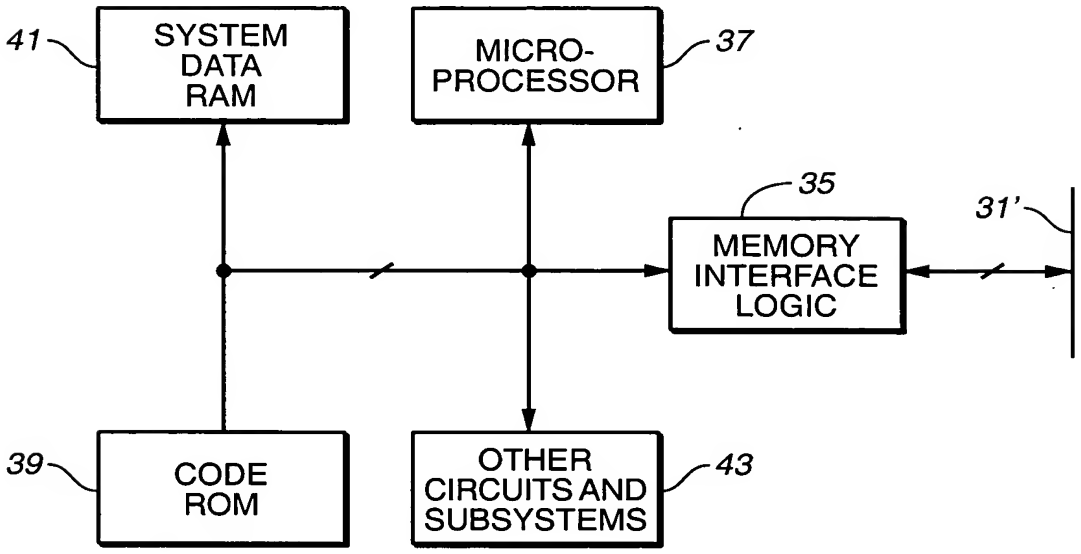


FIG._1B

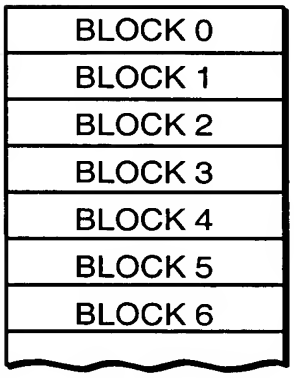


FIG._2

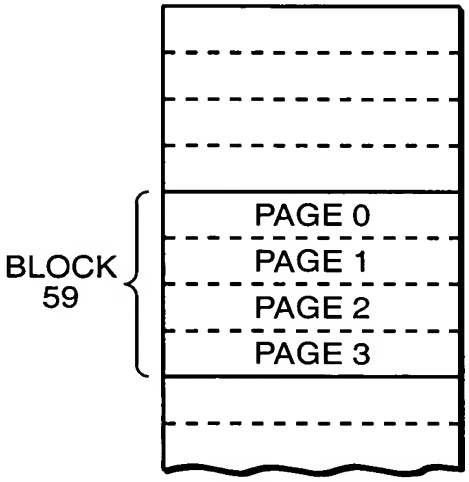


FIG._4

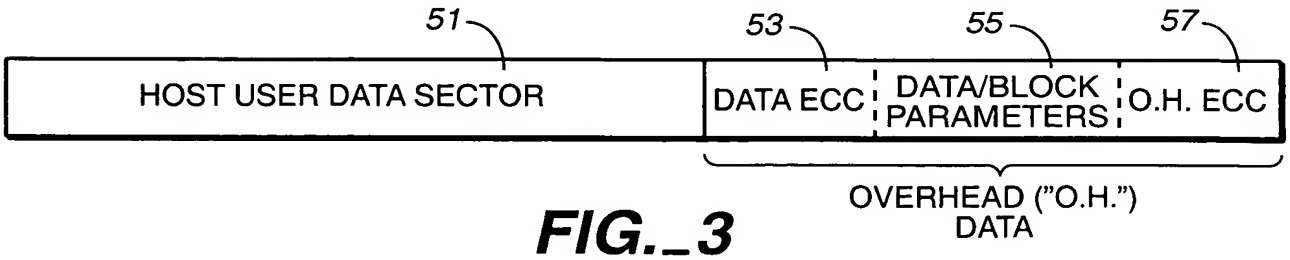


FIG._3

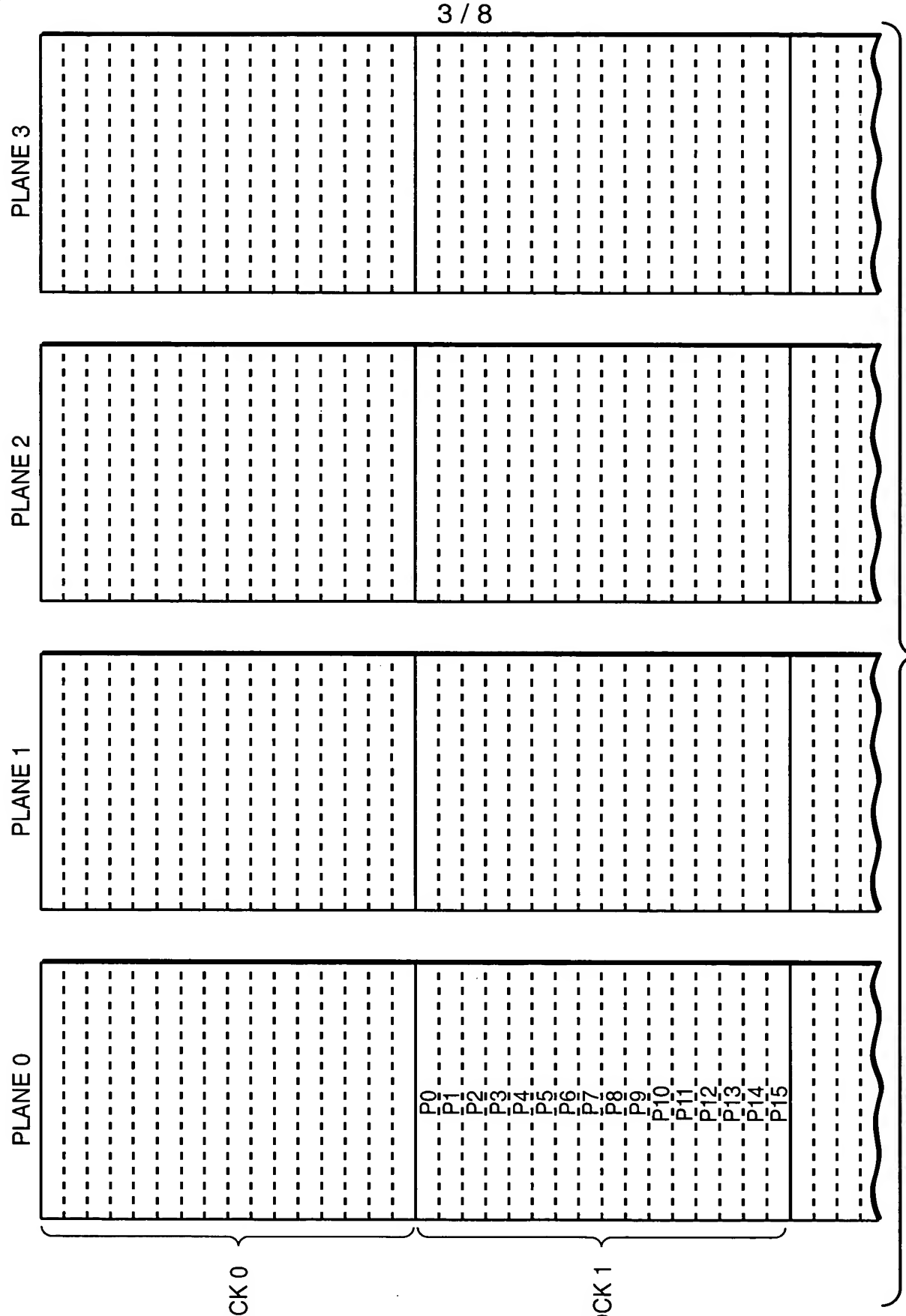

PLANE 3
PLANE 2
PLANE 1
PLANE 0
P0
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
P13
P14
P15
BLOCK 0
BLOCK 1

FIG._5

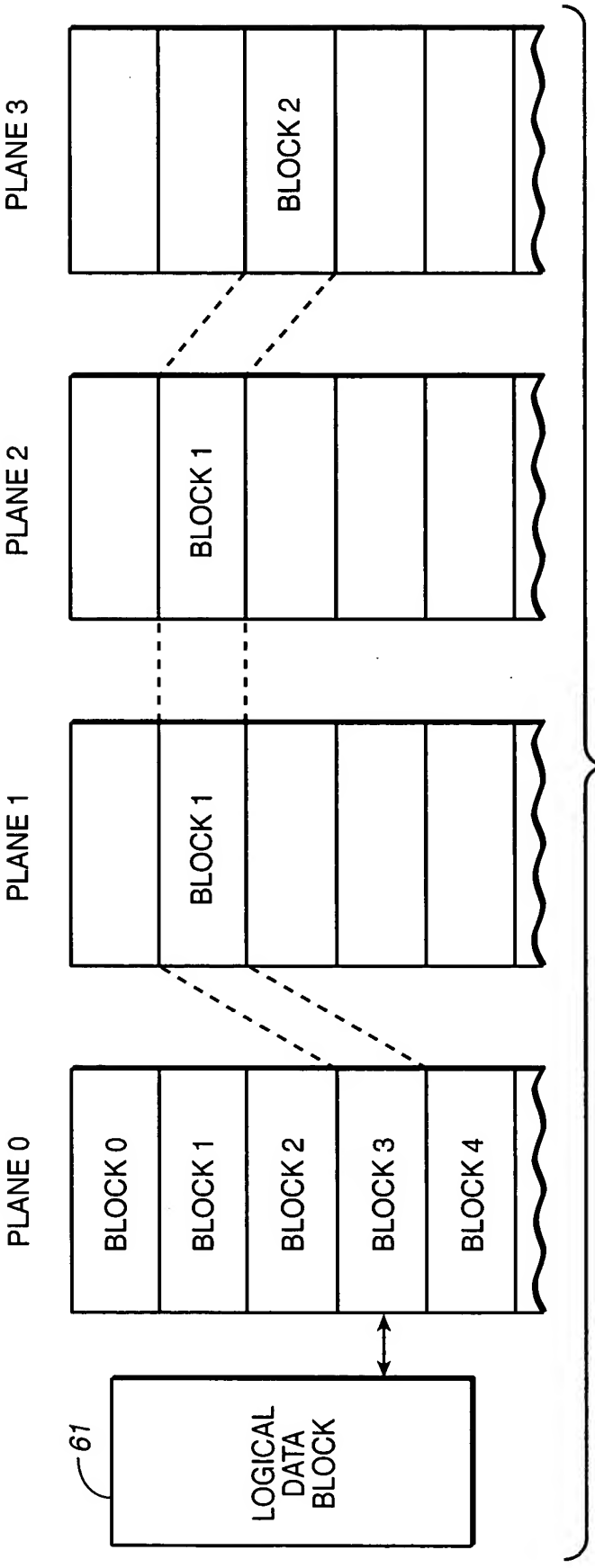

PLANE 3
PLANE 2
PLANE 1
PLANE 0
BLOCK 2
BLOCK 1
BLOCK 1
BLOCK 0
BLOCK 1
BLOCK 2
BLOCK 3
BLOCK 4
61
LOGICAL DATA BLOCK

FIG._6

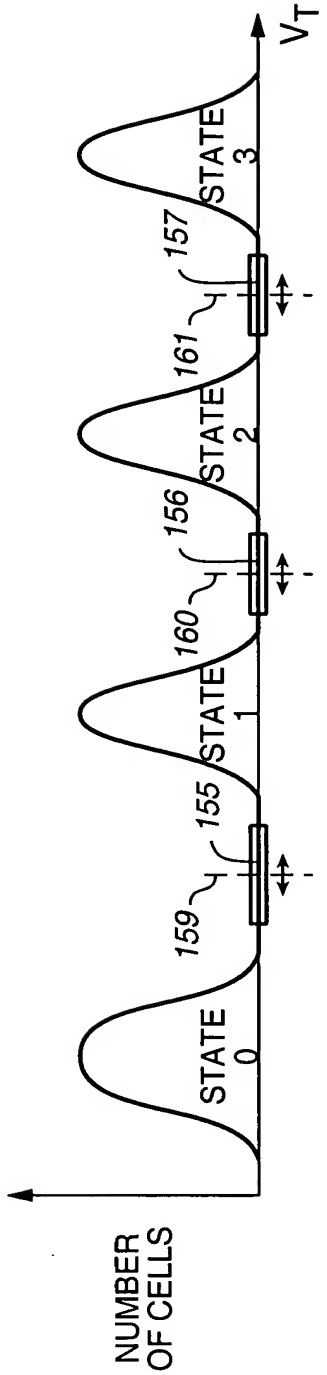

V_T
NUMBER OF CELLS
STATE 0
STATE 1
STATE 2
STATE 3
155
156
157
159
160
161

FIG._10

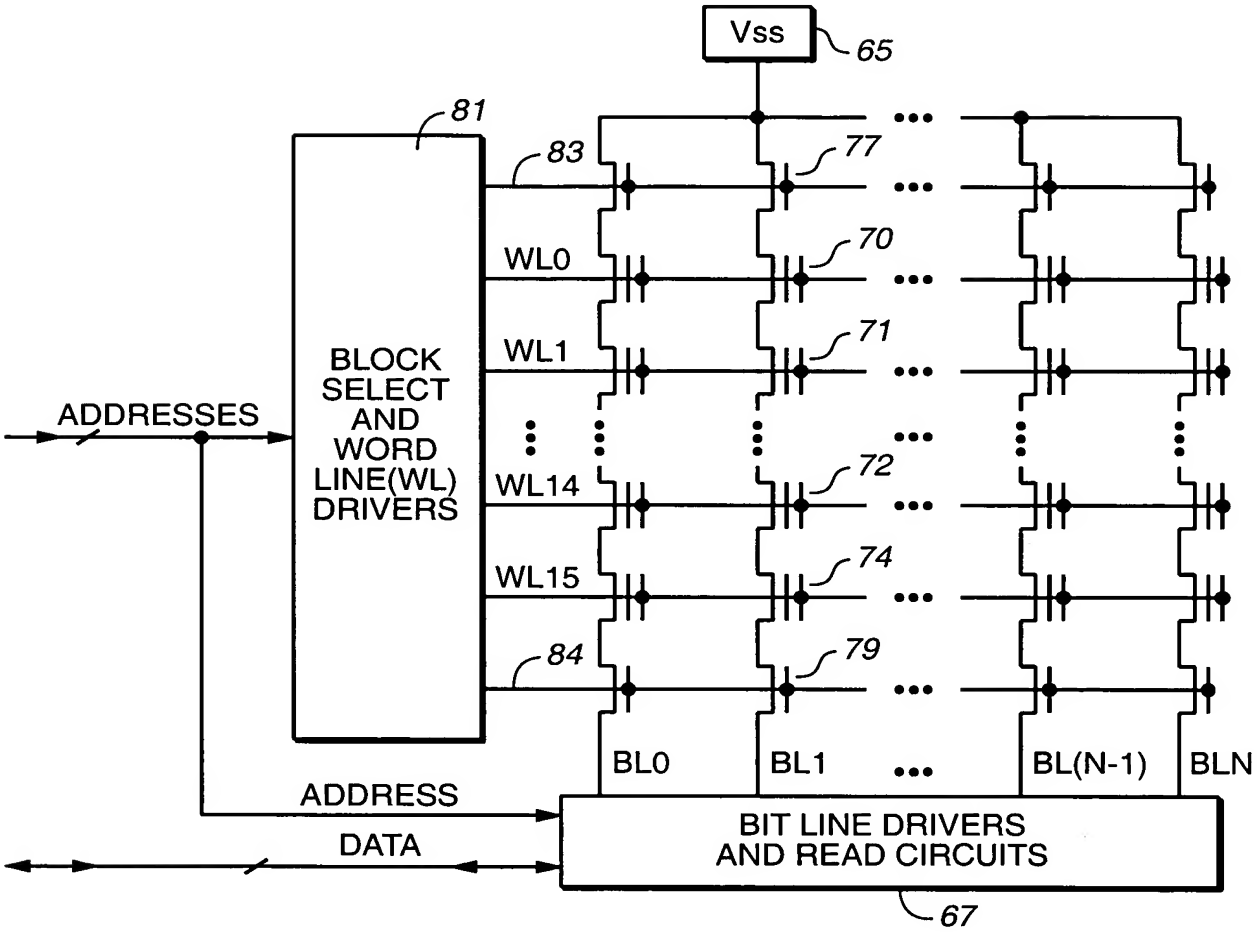

Vss
65
81
83
77
WL0
70
WL1
71
BLOCK SELECT AND WORD LINE(WL) DRIVERS
ADDRESSES
WL14
72
WL15
74
84
79
BL0
BL1
BL(N-1)
BLN
ADDRESS
DATA
BIT LINE DRIVERS AND READ CIRCUITS
67

FIG._7

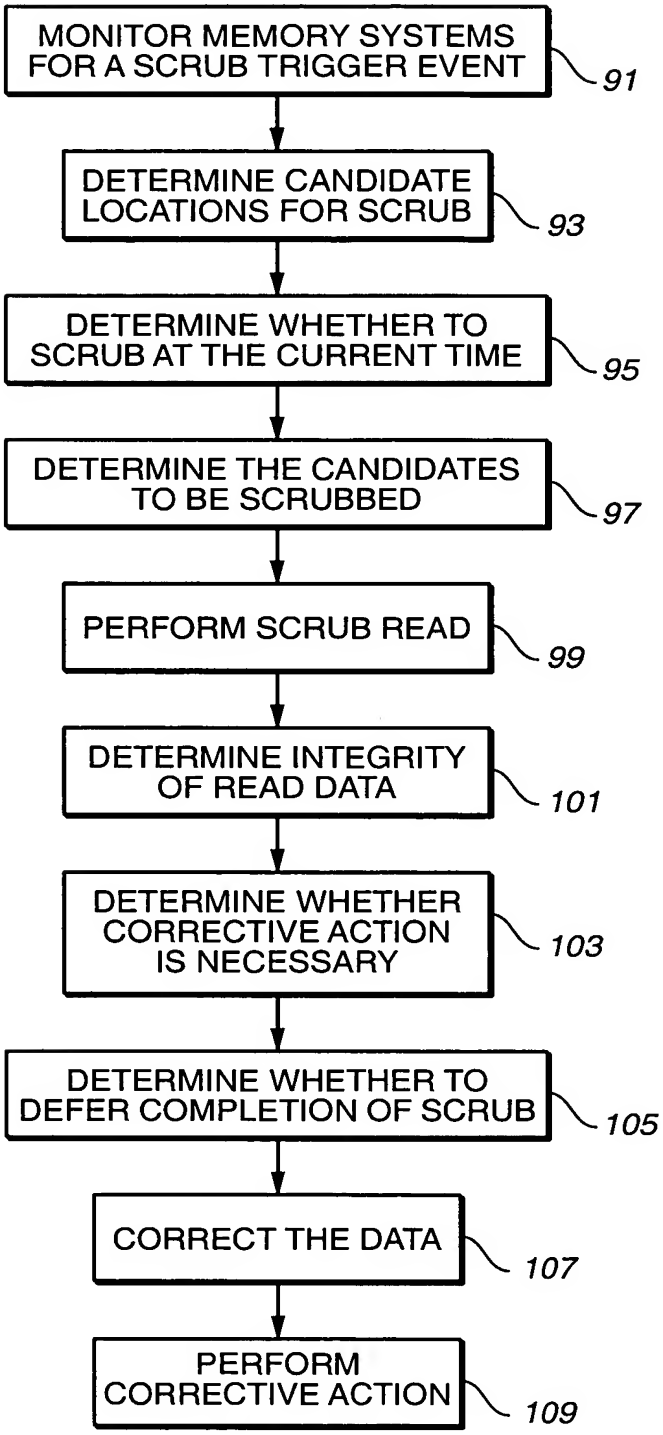

MONITOR MEMORY SYSTEMS FOR A SCRUB TRIGGER EVENT
91
DETERMINE CANDIDATE LOCATIONS FOR SCRUB
93
DETERMINE WHETHER TO SCRUB AT THE CURRENT TIME
95
DETERMINE THE CANDIDATES TO BE SCRUBBED
97
PERFORM SCRUB READ
99
DETERMINE INTEGRITY OF READ DATA
101
DETERMINE WHETHER CORRECTIVE ACTION IS NECESSARY
103
DETERMINE WHETHER TO DEFER COMPLETION OF SCRUB
105
CORRECT THE DATA
107
PERFORM CORRECTIVE ACTION
109

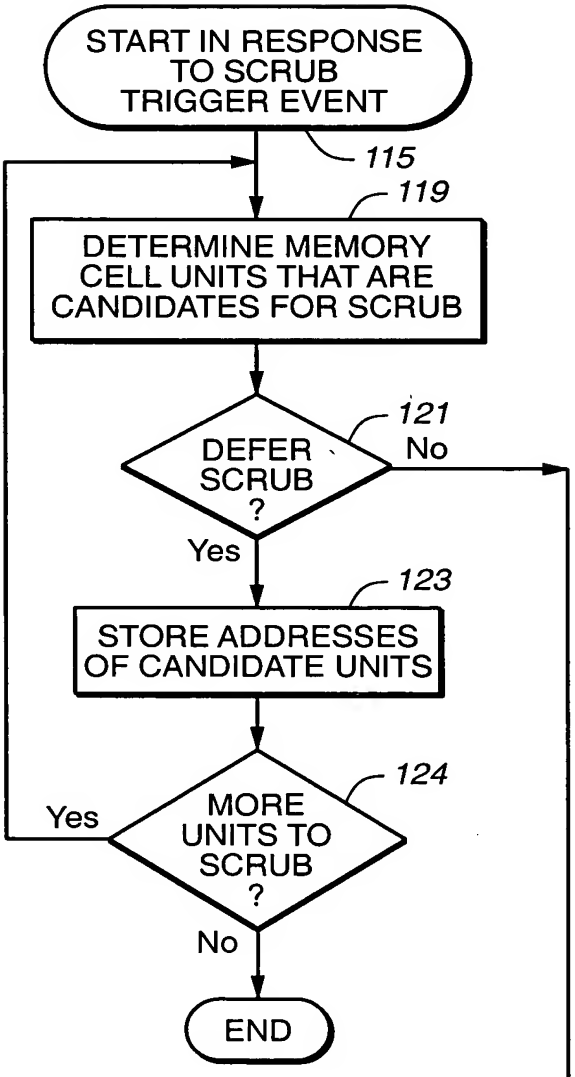
FIG._8

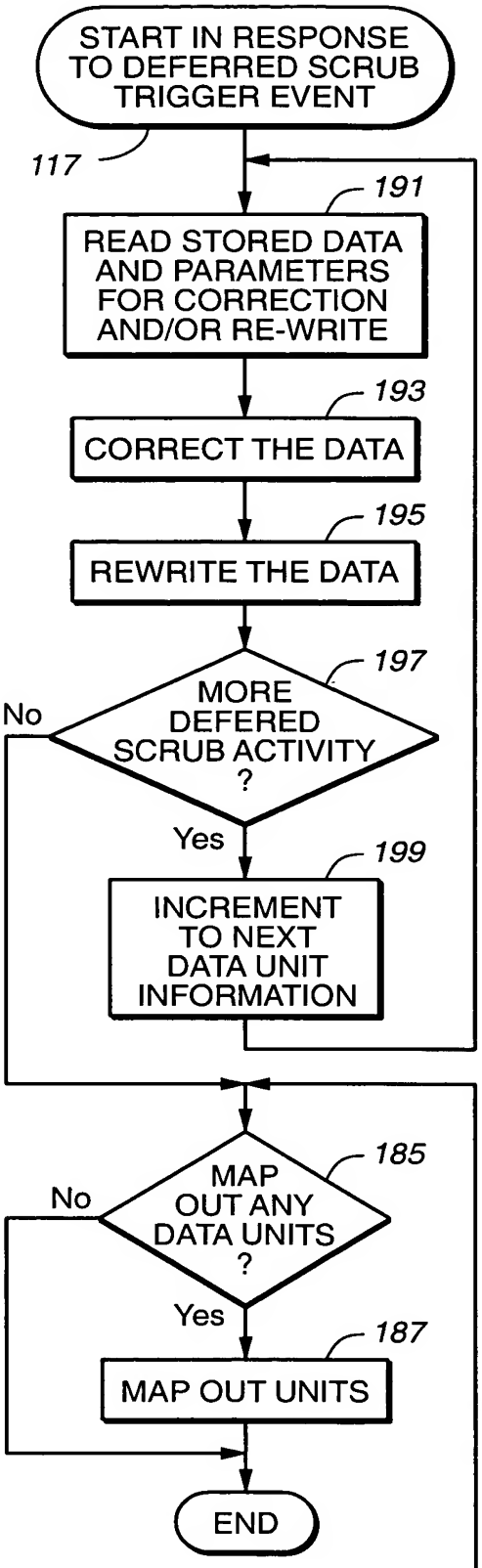
FIG._9

FIG._9A

FIG._9B

FIG._9A





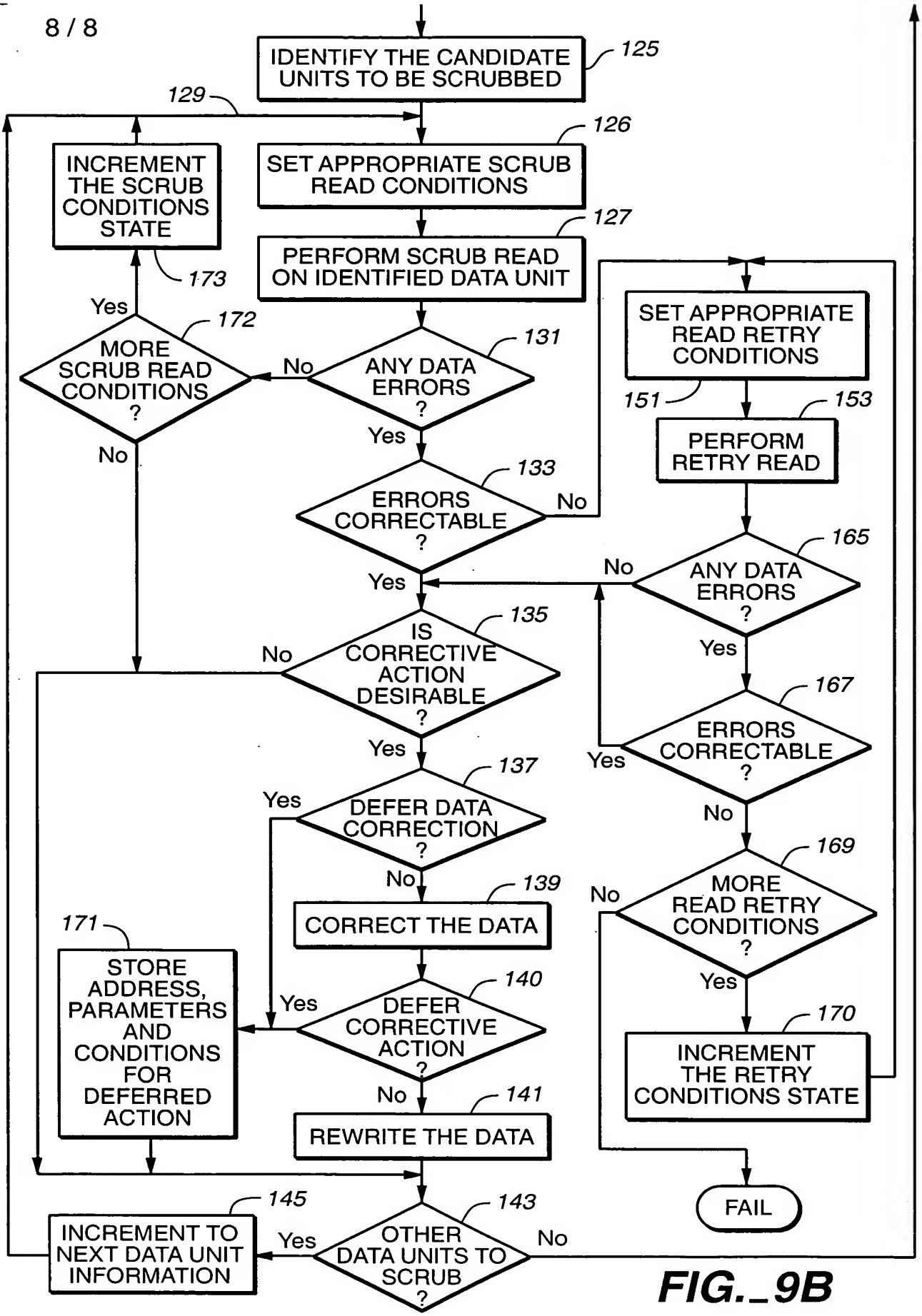

IDENTIFY THE CANDIDATE UNITS TO BE SCRUBBED
125
129
126
SET APPROPRIATE SCRUB READ CONDITIONS
INCREMENT THE SCRUB CONDITIONS STATE
127
PERFORM SCRUB READ ON IDENTIFIED DATA UNIT
173
Yes
172
MORE SCRUB READ CONDITIONS ?
No
131
ANY DATA ERRORS ?
No
Yes
133
ERRORS CORRECTABLE ?
No
Yes
135
IS CORRECTIVE ACTION DESIRABLE ?
No
Yes
137
DEFER DATA CORRECTION ?
Yes
No
139
CORRECT THE DATA
171
STORE ADDRESS, PARAMETERS AND CONDITIONS FOR DEFERRED ACTION
Yes
140
DEFER CORRECTIVE ACTION ?
No
141
REWRITE THE DATA
145
INCREMENT TO NEXT DATA UNIT INFORMATION
Yes
143
OTHER DATA UNITS TO SCRUB ?
No
SET APPROPRIATE READ RETRY CONDITIONS
151
153
PERFORM RETRY READ
165
No
ANY DATA ERRORS ?
Yes
167
ERRORS CORRECTABLE ?
Yes
No
169
No
MORE READ RETRY CONDITIONS ?
Yes
170
INCREMENT THE RETRY CONDITIONS STATE
FAIL

FIG._9B